

#### SEQUENCE LISTING

COPY OF PAPERS ORIGINALLY FILED

46

46

<110>	Roberts,	Shannon
	Sherman,	Amir
	Trueheart	, Joshua
	Milne, G.	Todd

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Lys Glu Val Thr Gly Arg Ala Pro Cys Gln Arg Cys Gln Gln Ala Gly
                        55
Leu Arg Cys Val Tyr Ser Glu Arg Arg Pro Lys Arg Lys Leu Arg Gln
                    70
                                       75
Ser Arg Ala Ala Asp Leu Val Ser Ala Asp Pro Asp Pro Cys Leu His
                                    90
               85
Met Ser Ser Pro Pro Val Pro Ser Gln Ser Leu Pro Leu Asp Val Ser
                                105
            100
                                                   110
Glu Ser His Ser Ser Asn Thr Ser Arg Gln Phe Leu Asp Pro Pro Asp
                            120
                                                125
Ser Tyr Asp Trp Ser Trp Thr Ser Ile Gly Thr Asp Glu Ala Ile Asp
                        135
                                            140
Thr Asp Cys Trp Gly Leu Ser Gln Cys Asp Gly Gly Phe Ser Cys Gln
                    150
                                        155
Leu Glu Pro Thr Leu Pro Asp Leu Pro Ser Pro Phe Glu Ser Thr Val
                                    170
Glu Lys Ala Pro Leu Pro Pro Val Ser Ser Asp Ile Ala Arg Ala Ala
```

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185
                                                   190
           180
Ser Ala Gln Arg Glu Leu Phe Asp Asp Leu Ser Ala Val Ser Gln Glu
                          200
Leu Glu Glu Ile Leu Leu Ala Val Thr Val Glu Trp Pro Lys Gln Glu
                       215
                                           220
Ile Trp Thr His Pro Ile Gly Met Phe Phe Asn Ala Ser Arg Arg Leu
                   230
                                       235
Leu Thr Val Leu Arg Gln Gln Ala Gln Ala Asp Cys His Gln Gly Ala
                                   250
               245
Leu Asp Glu Cys Leu Arg Thr Lys Asn Leu Phe Thr Ala Val His Cys
                               265
Tyr Ile Leu Asn Val Arg Ile Leu Thr Ala Ile Ser Glu Leu Leu
                                              285
                           280
Ser Gln Ile Arg Arg Thr Gln Asn Ser His Met Ser Pro Leu Glu Gly
                       295
                                           300
Ser Arg Ser Gln Ser Pro Ser Arg Asp Asp Thr Ser Ser Ser Gly
                                       315
                   310
His Ser Ser Val Asp Thr Ile Pro Phe Phe Ser Glu Asn Leu Pro Ile
               325
                                   330
Gly Glu Leu Phe Ser Tyr Val Asp Pro Leu Thr His Ala Leu Phe Ser
                               345
           340
Ala Cys Thr Thr Leu His Val Gly Val Gln Leu Leu Arg Glu Asn Glu
                           360
                                              365
Ile Thr Leu Gly Val His Ser Ala Gln Gly Ile Ala Ala Ser Ile Ser
                       375
                                           380
Met Ser Gly Glu Pro Gly Glu Asp Ile Ala Arg Thr Gly Ala Thr Asn
                                      395
                   390
Ser Ala Arg Cys Glu Glu Gln Pro Thr Thr Pro Ala Ala Arg Val Leu
               405
                                   410
Phe Met Phe Leu Ser Asp Glu Gly Ala Phe Gln Glu Ala Lys Ser Ala
                               425
                                                   430
Gly Ser Arg Gly Arg Thr Ile Ala Ala Leu Arg Arg Cys Tyr Glu Asp
                                               445
                           440
Ile Phe Ser Leu Ala Arg Lys His Lys His Gly Met Leu Arg Asp Leu
                        455
Asn Ser Ile Pro Pro
465
<210> 48
<211> 469
<212> PRT
<213> Artificial Sequence
<223> Amino acid sequence of variants of the lovE Gene
<400> 48
Met Ala Ala Asp Gln Gly Ile Phe Thr Asn Ser Val Thr Leu Ser Pro
                                    10
Val Glu Gly Ser Arg Thr Gly Gly Thr Leu Pro Arg Arg Ala Phe Arg
                                2.5
            20
Arg Ser Cys Asp Arg Cys His Ala Gln Lys Ile Lys Cys Thr Gly Asn
                           40
                                               45
Lys Glu Val Thr Gly Arg Ala Pro Cys Gln Arg Cys Gln Gln Ala Gly
                        55
Leu Arg Cys Val Tyr Ser Glu Arg Arg Pro Lys Arg Lys Leu Arg Gln
```

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70
                                      75
65
Ser Arq Ala Ala Asp Leu Val Ser Ala Asp Pro Asp Pro Cys Leu His
                                 90
        85
Met Ser Ser Pro Pro Val Pro Ser Gln Ser Leu Pro Leu Asp Val Ser
                             105
                                       110
          100
Glu Ser His Ser Ser Asn Thr Ser Arg Gln Phe Leu Asp Pro Pro Asp
                                      125
                          120
Ser Tyr Asp Trp Ser Trp Thr Ser Ile Gly Thr Asp Glu Ala Ile Asp
                     135
                                         140
Thr Asp Cys Trp Gly Leu Ser Gln Cys Asp Gly Gly Phe Ser Cys Gln
                 150
                                     155
Leu Glu Pro Thr Leu Pro Asp Leu Pro Ser Pro Phe Glu Ser Thr Val
              165
                                  170
Glu Lys Ala Pro Leu Pro Pro Val Ser Ser Asp Ile Ala Arg Ala Ala
          180
                              185
Ser Ala Gln Arg Glu Leu Phe Asp Asp Leu Ser Ala Val Ser Gln Glu
                          200
                                             205
Leu Glu Glu Ile Leu Leu Ala Val Thr Val Glu Trp Pro Lys Gln Glu
                      215
                                         220
Ile Trp Thr His Pro Ile Gly Met Phe Phe Asn Ala Ser Arg Arg Leu
                 230
                                     235
Leu Thr Val Leu Arg Gln Gln Ala Gln Ala Asp Cys His Gln Gly Ala
              245
                                  250
Leu Asp Glu Cys Leu Arg Thr Lys Asn Leu Phe Thr Ala Val His Cys
          260
                              265
Tyr Ile Leu Asn Val Arg Ile Leu Thr Ala Ile Ser Glu Leu Leu
      275
                          280
Ser Gln Ile Arg Arg Thr Gln Asn Ser His Met Ser Pro Leu Glu Gly
                    295
                                          300
Ser Arg Ser Gln Ser Pro Ser Arg Asp Asp Thr Ser Ser Ser Gly
                 310
                                     315
His Ser Ser Val Asp Thr Ile Pro Phe Phe Ser Glu Asn Leu Pro Ile
                                  330
              325
Gly Glu Leu Phe Ser Tyr Val Asp Pro Leu Thr His Ala Leu Phe Ser
          340
                             345
Ala Cys Thr Thr Leu His Val Gly Val Gln Leu Leu Arg Glu Asn Glu
                          360
Ile Thr Leu Gly Val His Ser Ala Gln Gly Ile Ala Ala Ser Ile Ser
                      375
Met Ser Gly Glu Pro Gly Glu Asp Ile Ala Arg Thr Gly Ala Thr Asn
                  390
                                      395
Ser Ala Arg Cys Glu Glu Gln Pro Thr Thr Pro Ala Ala Arg Val Leu
              405
                                  410
Phe Met Phe Leu Ser Asp Glu Gly Ala Phe Gln Glu Ala Lys Ser Ala
           420
                              425
Gly Ser Arg Gly Arg Thr Ile Ala Ala Leu Arg Arg Cys Tyr Glu Asp
       435
                          440
Ile Phe Ser Leu Ala Arg Lys His Lys His Gly Met Leu Arg Asp Leu
                       455
Asn Ser Ile Pro Pro
```

<sup>&</sup>lt;210> 49

<sup>&</sup>lt;211> 469

<sup>&</sup>lt;212> PRT

<sup>&</sup>lt;213> Artificial Sequence

<220> <223> Amino acid sequence of variants of the lovE Gene <400> 49 Met Ala Ala Asp Gln Gly Ile Phe Thr Asn Ser Val Thr Leu Ser Pro Val Glu Gly Ser Arg Thr Gly Gly Thr Leu Pro Arg Arg Ala Phe Arg Arg Ser Cys Asp Arg Cys His Ala Gln Lys Ile Lys Cys Thr Gly Asn 40 Lys Glu Val Thr Gly Arg Ala Pro Cys Gln Arg Cys Gln Gln Ala Gly Leu Arg Cys Val Tyr Ser Glu Arg Arg Pro Lys Arg Lys Leu Arg Gln 75 70 Ser Arg Ala Ala Asp Leu Val Ser Ala Asp Pro Asp Pro Cys Leu His 85 90 Met Ser Ser Pro Pro Val Pro Ser Gln Ser Leu Pro Leu Asp Val Ser 100 105 Glu Ser His Ser Ser Asn Thr Ser Arg Gln Phe Leu Asp Pro Pro Asp 120 Ser Tyr Asp Trp Ser Trp Thr Ser Ile Gly Thr Asp Glu Ala Ile Asp 135 140 Thr Asp Cys Trp Gly Leu Ser Gln Cys Asp Gly Gly Phe Ser Cys Gln 150 155 Leu Glu Pro Thr Leu Pro Asp Leu Pro Ser Pro Phe Glu Ser Thr Val 165 170 Glu Lys Ala Pro Leu Pro Pro Val Ser Ser Asp Ile Ala Arg Ala Ala 180 185 190 Ser Ala Gln Arg Glu Leu Phe Asp Asp Leu Ser Ala Val Ser Gln Glu 195 200 205 Leu Glu Glu Ile Leu Leu Ala Val Thr Val Glu Trp Pro Lys Gln Glu 215 220 Ile Trp Thr His Pro Ile Gly Met Phe Phe Asn Ala Ser Arg Arg Leu 230 235 Leu Thr Val Leu Arg Gln Gln Ala Gln Ala Asp Cys His Gln Gly Ala 250 Leu Asp Glu Cys Leu Arg Thr Lys Asn Leu Phe Thr Ala Val His Cys 260 265 Tyr Ile Leu Asn Val Arg Ile Leu Thr Ala Ile Ser Glu Leu Leu Leu 280 285 Ser Gln Ile Arg Arg Thr Gln Asn Ser His Met Ser Pro Leu Glu Gly 295 300 Ser Arg Ser Gln Ser Pro Ser Arg Asp Asp Thr Ser Ser Ser Gly 310 315 320 His Ser Ser Val Asp Thr Ile Pro Phe Phe Ser Glu Asn Leu Pro Ile 325 330 Gly Glu Leu Phe Ser Tyr Val Asp Pro Leu Thr His Ala Leu Phe Ser 345 Ala Cys Thr Thr Leu His Val Gly Val Gln Leu Leu Arg Glu Asn Glu 360 Ile Thr Leu Gly Val His Ser Ala Gln Gly Ile Ala Ala Ser Ile Ser 375 380 Met Ser Gly Glu Pro Gly Glu Asp Ile Ala Arg Thr Gly Ala Thr Asn 390 395 Ser Ala Arg Cys Glu Glu Gln Pro Thr Thr Pro Ala Ala Arg Val Leu 405 410 Phe Met Phe Leu Ser Asp Glu Gly Ala Phe Gln Glu Ala Lys Ser Ala

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425
           420
                                                 430
Gly Ser Arg Gly Arg Thr Ile Ala Ala Leu Arg Arg Cys Tyr Glu Asp
                   440
                                      445
Ile Phe Ser Leu Ala Arg Lys His Lys His Gly Met Leu Arg Asp Leu
                       455
Asn Ser Ile Pro Pro
<210> 50
<211> 469
<212> PRT
<213> Artificial Sequence
<223> Amino acid sequence of variants of the lovE Gene
<400> 50
Met Ala Ala Asp Gln Gly Ile Phe Thr Asn Ser Val Thr Leu Ser Pro
                                  10
Val Glu Gly Ser Arg Thr Gly Gly Thr Leu Pro Arg Arg Ala Phe Arg
                              25
Arg Ser Cys Asp Arg Cys His Ala Gln Lys Ile Lys Cys Thr Gly Asn
                          40
Lys Glu Val Thr Gly Arg Ala Pro Cys Gln Arg Cys Gln Gln Ala Gly
                      55
Leu Arg Cys Val Tyr Ser Glu Arg Arg Pro Lys Arg Lys Leu Arg Gln
                   70
                                     75
Ser Arq Ala Ala Asp Leu Val Ser Ala Asp Pro Asp Pro Cys Leu His
                                  90
              85
Met Ser Ser Pro Pro Val Pro Ser Gln Ser Leu Pro Leu Asp Val Ser
                              105
          100
Glu Ser His Ser Ser Asn Thr Ser Arg Gln Phe Leu Asp Pro Pro Asp
                          120
                                             125
Ser Tyr Asp Trp Ser Trp Thr Ser Ile Gly Thr Asp Glu Ala Ile Asp
                     135
                                          140
Thr Asp Cys Trp Gly Leu Ser Gln Cys Asp Gly Gly Phe Ser Cys Gln
                 150
                                     155
Leu Glu Pro Thr Leu Pro Asp Leu Pro Ser Pro Phe Glu Ser Thr Val
                                 170
              165
Glu Lys Ala Pro Leu Pro Pro Val Ser Ser Asp Ile Ala Arg Ala Ala
                             185
                                                190
          180
Ser Ala Gln Arg Glu Leu Phe Asp Asp Leu Ser Ala Val Ser Gln Glu
                          200
                                             205
Leu Glu Glu Ile Leu Leu Ala Val Thr Val Glu Trp Pro Lys Gln Glu
                      215
                                         220
Ile Trp Thr His Pro Ile Gly Met Phe Phe Asn Ala Ser Arg Arg Leu
                  230
                                      235
Leu Thr Val Leu Arg Gln Gln Ala Gln Ala Asp Cys His Gln Gly Ala
                                  250
               245
Leu Asp Glu Cys Leu Arg Thr Lys Asn Leu Phe Thr Ala Val His Cys
                              265
           260
Tyr Ile Leu Asn Val Arg Ile Leu Thr Ala Ile Ser Glu Leu Leu
                          280
Ser Gln Ile Arg Arg Thr Gln Asn Ser His Met Ser Pro Leu Glu Gly
                       295
Ser Arg Ser Gln Ser Pro Ser Arg Asp Asp Thr Ser Ser Ser Gly
```

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315
                   310
305
His Ser Ser Val Asp Thr Ile Pro Phe Phe Ser Glu Asn Leu Pro Ile
            325
                        330
Gly Glu Leu Phe Ser Tyr Val Asp Pro Leu Thr His Ala Leu Phe Ser
                              345
Ala Cys Thr Thr Leu His Val Gly Val Gln Leu Leu Arg Glu Asn Glu
                         360
Ile Thr Leu Gly Val His Ser Ala Gln Gly Ile Ala Ala Ser Ile Ser
                      375
                                          380
Met Ser Gly Glu Pro Gly Glu Asp Ile Ala Arg Thr Gly Ala Thr Asn
                  390
                                     395
Ser Ala Arg Cys Glu Glu Gln Pro Thr Thr Pro Ala Ala Arg Val Leu
                                  410
Phe Met Phe Leu Ser Asp Glu Gly Ala Phe Gln Glu Ala Lys Ser Ala
                             425
Gly Ser Arg Gly Arg Thr Ile Ala Ala Leu Arg Arg Cys Tyr Glu Asp
                          440
                                             445
Ile Phe Ser Leu Ala Arg Lys His Lys His Gly Met Leu Arg Asp Leu
Asn Ser Ile Pro Pro
<210> 51
<211> 469
<212> PRT
<213> Artificial Sequence
<223> Amino acid sequence of variants of the lovE Gene
<400> 51
Met Ala Ala Asp Gln Gly Ile Phe Met Asn Ser Val Thr Leu Ser Ala
                                  10
Val Glu Gly Ser Arg Thr Ser Gly Thr Leu Pro Arg Arg Ala Phe Arg
                              25
Arg Ser Cys Asp Arg Cys His Ala Lys Lys Ile Lys Cys Thr Gly Asn
                          40
Lys Glu Val Thr Gly Arg Ala Pro Cys Gln Arg Cys Gln Gln Ala Gly
                       55
Leu Arg Cys Val Tyr Ser Glu Arg Cys Pro Lys Arg Lys Leu Arg Gln
Ser Arg Ala Ala Asp Leu Val Ser Ala Asp Pro Asp Pro Cys Leu His
              85
                                  90
Met Ser Ser Pro Pro Val Pro Ser Gln Ser Leu Pro Leu Asp Val Ser
           100
                              105
                                                 110
Glu Ser His Ser Ser Asn Thr Ser Arg Gln Phe Leu Asp Pro Pro Asp
                          120
                                             125
Ser Tyr Asp Trp Ser Trp Thr Ser Ile Gly Thr Asp Glu Ala Ile Asp
                     135
                                          140
Thr Asp Cys Trp Gly Leu Ser Gln Cys Asp Gly Gly Phe Ser Cys Gln
                 150
                                    155
Leu Glu Pro Thr Leu Pro Asp Leu Pro Ser Pro Phe Glu Ser Thr Val
              165 170
Glu Lys Ala Pro Leu Pro Pro Val Ser Ser Asp Ile Ala Arg Ala Ala
                             185
Ser Ala Gln Arg Glu Leu Phe Asp Asp Leu Ser Ala Val Ser Gln Glu
```

200 Leu Glu Glu Ile Leu Leu Ala Val Thr Val Glu Trp Pro Lys Gln Glu

```
215
Ile Trp Thr His Pro Ile Gly Met Phe Phe Asn Ala Ser Arg Arg Leu
                   230
Leu Thr Val Leu Arg Gln Gln Ala Gln Ala Asp Cys His Gln Gly Thr
                                   250
              245
Leu Asp Glu Cys Leu Arg Thr Lys Asn Leu Phe Thr Ala Val His Cys
           260
                               265
Tyr Ile Leu Asn Val Arg Ile Leu Thr Ala Ile Ser Glu Leu Leu
                           280
Ser Gln Ile Arg Arg Thr Gln Asn Ser His Met Ser Pro Leu Glu Gly
                      295
                                           300
Ser Arg Ser Gln Ser Pro Ser Arg Asp Asp Thr Ser Ser Ser Gly
                   310
                                      315
His Ser Ser Val Asp Thr Ile Pro Phe Phe Ser Glu Asn Leu Pro Ile
                                  330
               325
Gly Glu Leu Phe Ser Tyr Val Asp Pro Leu Thr His Ala Leu Phe Ser
                               345
Ala Cys Thr Thr Leu His Val Gly Val Glu Leu Leu Arg Glu Asn Glu
                           360
Ile Thr Leu Gly Val His Ser Ala Gln Gly Ile Ala Ala Ser Ile Ser
                       375
Met Ser Gly Glu Pro Gly Glu Asp Ile Ala Arg Thr Gly Ala Thr Asn
                   390
                                       395
Ser Ala Arg Cys Glu Glu Gln Pro Thr Thr Pro Ala Ala Arg Val Leu
                                   410
               405
Phe Met Phe Leu Ser Asp Glu Gly Ala Phe Gln Glu Ala Lys Ser Ala
                               425
           420
Gly Ser Arg Gly Arg Thr Ile Ala Ala Leu Arg Arg Cys Tyr Glu Asp
                           440
                                              445
Ile Phe Ser Leu Ala Arg Lys His Lys His Gly Met Leu Arg Asp Leu
                       455
Asn Asn Ile Pro Pro
465
<210> 52
<211> 469
<212> PRT
<213> Artificial Sequence
<223> Amino acid sequence of variants of the lovE Gene
<400> 52
Met Ala Ala Asp Gln Gly Ile Phe Thr Asn Ser Val Thr Leu Ser Pro
                                   10
Val Glu Gly Ser His Thr Gly Gly Thr Leu Pro Arg Arg Ala Phe Arg
                               25
            20
Arg Ala Cys Asp Arg Cys His Ala Gln Lys Ile Lys Cys Thr Gly Asn
       35
                           40
Lys Glu Val Thr Gly Arg Ala Pro Cys Gln Arg Cys Gln Gln Ala Gly
                      55
Leu Arg Cys Val Tyr Ser Glu Arg Cys Pro Lys Arg Lys Leu Arg His
                                       7.5
                   70
Ser Arg Ala Ser Asp Leu Val Ser Ala Asp Pro Asp Pro Cys Leu His
```

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```
90
               85
Met Ser Ser Pro Pro Val Pro Ser Gln Ser Leu Pro Leu Asp Val Ser
          100
                    105
                                        110
Glu Ser His Ser Ser Asn Thr Ser Arg Gln Phe Leu Asp Pro Pro Asp
                         120
                                             125
       115
Ser Tyr Asp Trp Ser Trp Thr Ser Ile Gly Thr Asp Glu Ala Ile Asp
                     135
                                         140
Thr Asp Cys Trp Gly Leu Ser Gln Cys Asp Gly Gly Phe Ser Cys Gln
                  150
                                     155
Leu Glu Pro Thr Leu Pro Asp Leu Pro Ser Pro Phe Glu Ser Thr Val
                                 170
              165
Glu Lys Ala Pro Leu Pro Pro Val Ser Ser Asp Ile Ala Arg Ala Ala
                             185
Ser Ala Gln Arg Glu Leu Phe Asp Asp Leu Ser Ala Val Ser Gln Glu
                          200
Leu Glu Glu Ile Leu Leu Ala Val Thr Val Glu Trp Pro Lys Gln Glu
                      215
Ile Trp Thr His Pro Ile Gly Met Phe Phe Asn Ala Ser Arg Arg Leu
                  230
Leu Thr Val Leu Arg Gln Gln Ala Gln Ala Asp Cys His Gln Gly Thr
              245
                                 250
Leu Asp Glu Cys Leu Arg Thr Lys Asn Leu Phe Thr Ala Val His Cys
          260
                              265
Tyr Ile Leu Asn Val Arg Ile Leu Thr Ala Ile Ser Glu Leu Leu Leu
                          280
                                             285
Ser Gln Ile Arg Arg Thr Gln Asn Ser His Met Ser Pro Leu Asp Gly
                      295
                                          300
Ser Arg Ser Gln Ser Pro Ser Arg Asp Asp Thr Ser Ser Ser Ser Gly
                  310
                                     315
His Ser Ser Val Asp Thr Ile Pro Phe Phe Ser Glu Asn Leu Pro Ile
               325
                                  330
Gly Glu Leu Phe Ser Tyr Val Asp Pro Leu Thr His Ala Leu Phe Ser
           340
                              345
Ala Cys Thr Thr Leu His Val Gly Val Gln Leu Leu Arg Glu Asn Glu
                          360
Ile Thr Leu Gly Val Asp Ser Ala Gln Gly Ile Ala Ala Ser Ile Ser
                      375
                                         380
Met Ser Gly Glu Pro Gly Glu Asp Ile Ala Arg Thr Gly Ala Thr Asn
                                   395
                  390
Ser Ala Arg Cys Glu Glu Gln Pro Thr Thr Pro Ala Ala Arg Val Leu
              405
                                 410
Phe Met Phe Leu Ser Asp Glu Gly Ala Phe Gln Glu Ala Lys Ser Ala
                             425
          420
Gly Ser Arg Gly Arg Thr Ile Thr Val Leu Arg Arg Ser Tyr Glu Asp
    435 440
Ile Phe Ser Leu Ala Arg Lys His Lys His Gly Met Leu Arg Asp Leu
                       455
Asn Asn Ile Pro Ser
465
<210> 53
<211> 469
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<212> PRT

<213> Artificial Sequence

<220>

<223> Amino acid sequence of variants of the lovE Gene

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<400> 53
Met Ala Ala Asp Gln Gly Ile Phe Thr Asn Ser Val Thr Leu Ser Pro
Val Glu Gly Ser Arg Thr Gly Gly Thr Leu Pro Arg Arg Ala Leu Arg
Arg Ser Cys Asp Arg Cys His Ala Gln Lys Ile Lys Cys Thr Gly Asn
                            40
Lys Glu Val Thr Gly Arg Ala Pro Cys Gln Arg Cys Gln Gln Ala Gly
                        55
Leu Arg Cys Val Tyr Ser Glu Arg Cys Pro Lys Arg Lys Leu Arg Gln
                                        75
                    70
Ser Arq Ala Ala Asp Leu Val Ser Ala Asp Pro Asp Pro Cys Leu His
                                   90
               85
Met Ser Ser Pro Pro Val Pro Ser Gln Ser Leu Pro Leu Asp Val Ser
                               105
                                                    110
           100
Glu Ser His Ser Ser Asn Thr Ser Arg Gln Phe Leu Asp Pro Pro Asp
                                               125
                           120
Ser Tyr Asp Trp Ser Trp Thr Ser Ile Gly Thr Asp Glu Ala Ile Asp
                       135
                                           140
Thr Asp Cys Trp Gly Leu Ser Gln Cys Asp Gly Gly Phe Ser Cys Gln
                   150
                                       155
Leu Glu Pro Thr Leu Pro Asp Leu Pro Ser Pro Phe Glu Ser Thr Val
                                   170
               165
Glu Lys Ala Pro Leu Pro Pro Val Ser Ser Asp Ile Ala Arg Ala Ala
                               185
           180
Ser Ala Gln Arg Glu Leu Phe Asp Asp Leu Ser Ala Val Ser Gln Glu
                           200
Leu Glu Glu Ile Leu Leu Ala Val Thr Val Glu Trp Pro Lys Gln Glu
                       215
                                           220
Ile Trp Thr His Pro Ile Gly Met Phe Phe Asn Ala Ser Arg Arg Leu
                                        235
                   230
Leu Thr Val Leu Arg Gln Gln Ala Gln Ala Asp Cys His Gln Gly Thr
                                   250
                245
Leu Asp Glu Cys Leu Arg Thr Lys Asn Leu Phe Thr Ala Val His Cys
            260
                                265
                                                    270
Tyr Ile Leu Asn Val Arg Ile Leu Thr Ala Ile Ser Glu Leu Leu
                            280
Ser Gln Ile Arg Arg Thr Gln Asn Ser His Met Ser Pro Leu Glu Gly
                                            300
                        295
Ser Arg Ser Gln Ser Pro Ser Arg Asp Asp Thr Ser Ser Ser Gly
                    310
                                        315
His Ser Ser Val Asp Thr Ile Pro Phe Phe Ser Glu Asn Leu Pro Ile
                325
                                    330
Gly Glu Leu Phe Ser Tyr Val Asp Pro Leu Thr His Ala Leu Phe Ser
                                345
Ala Cys Thr Thr Leu His Val Gly Val Gln Leu Leu Arg Glu Asn Glu
                            360
Ile Thr Leu Gly Val His Ser Ala Gln Gly Ile Ala Ala Ser Ile Ser
                        375
                                            380
Met Ser Gly Glu Pro Gly Glu Asp Ile Ala Arg Thr Gly Ala Thr Asn
                                        395
                    390
Ser Ala Arg Cys Glu Glu Gln Pro Ile Thr Pro Ala Ala Arg Val Leu
                405
                                   410
Phe Met Phe Leu Ser Asp Glu Gly Ala Phe Gln Glu Ala Lys Ser Ala
                                425
```

```
Gly Ser Arg Gly Arg Thr Ile Ala Ala Leu Arg Arg Cys Tyr Glu Asp
                            440
        435
Ile Phe Ser Leu Ala Arg Lys His Lys His Gly Met Leu Arg Asp Leu
                        455
Asn Asn Ile Pro Pro
465
<210> 54
<211> 469
<212> PRT
<213> Artificial Sequence
<220>
<223> Amino acid sequence of variants of the lovE Gene
<400> 54
Met Ala Ala Asp Gln Gly Ile Phe Thr Asn Ser Val Thr Leu Ser Pro
Val Glu Gly Ser Arg Thr Gly Gly Thr Leu Pro Arg Arg Ala Leu Arg
                                25
Arg Ser Cys Asp Arg Cys His Ala Gln Lys Ile Lys Cys Thr Gly Asn
                           40
Lys Glu Val Thr Gly Arg Ala Pro Cys Gln Arg Cys Gln Gln Ala Gly
                        55
Leu Arg Cys Val Tyr Ser Glu Arg Cys Pro Lys Arg Lys Leu Arg Gln
                   70
                                        75
Ser Arg Ala Ala Asp Leu Val Ser Ala Asp Pro Asp Pro Cys Leu His
                                    90
Ile Ser Ser Pro Pro Val Pro Ser Gln Ser Leu Pro Leu Asp Val Ser
           100
                                105
Àsp Ser His Ser Ser Asn Thr Ser Arg Gln Phe Leu Asp Pro Pro Asp
       115
                            120
Ser Tyr Asp Trp Ser Trp Thr Ser Ile Gly Thr Asp Glu Ala Ile Asp
                       135
Thr Asn Cys Trp Gly Leu Ser Gln Cys Asp Gly Gly Phe Ser Cys Gln
                   150
                                        155
Leu Glu Ser Thr Leu Pro Asp Leu Pro Ser Pro Phe Glu Ser Thr Val
               165
                                   170
Glu Lys Ala Pro Leu Pro Pro Val Ser Ser Asp Ile Ala Arg Ala Ala
                               185
           180
                                                   190
Ser Ala Gln Arg Glu Leu Phe Asp Asp Leu Ser Ala Val Ser Gln Glu
       195
                           200
                                               205
Leu Glu Glu Ile Leu Leu Ala Val Thr Val Glu Trp Pro Lys Gln Glu
                       215
                                           220
Ile Trp Thr His Pro Ile Gly Met Phe Phe Asn Ala Ser Arg Arg Leu
                   230
                                       235
Leu Thr Val Leu Arg Gln Gln Ala Gln Ala Asp Cys His Gln Gly Thr
               245
                                   250
Leu Asp Glu Cys Leu Arg Thr Lys Asn Leu Phe Thr Ala Val His Cys
            260
                                265
Tyr Ile Leu Asn Val Arg Ile Leu Thr Ala Ile Ser Glu Leu Leu Leu
                            280
Ser Gln Ile Arg Arg Thr Gln Asn Ser His Met Ser Pro Leu Glu Gly
                        295
Ser Arg Ser Gln Ser Pro Ser Arg Asp Asp Thr Ser Ser Ser Gly
                    310
                                        315
                                                            320
```

```
His Ser Ser Val Asp Thr Ile Pro Phe Phe Ser Glu Asn Leu Pro Ile
                325
                                    330
Gly Glu Leu Phe Ser Tyr Val Asp Pro Leu Thr His Ala Leu Phe Ser
                                345
Ala Cys Thr Thr Leu His Val Gly Val Gln Leu Leu Arg Glu Ile Glu
                            360
Ile Thr Leu Gly Val His Ser Ala Gln Gly Ile Ala Ala Ser Ile Ser
                        375
Met Ser Gly Glu Pro Gly Glu Asp Ile Ala Arg Thr Gly Ala Thr Asn
                    390
                                        395
Ser Ala Arg Cys Glu Glu Gln Pro Thr Thr Pro Ala Ala Arg Val Leu
                                    410
               405
Phe Met Phe Leu Ser Asp Glu Gly Ala Phe Gln Glu Ala Lys Ser Ala
                               425
           420
Gly Ser Arg Gly Arg Thr Ile Ala Ala Leu Arg Arg Cys Tyr Glu Asp
                    440
                                               445
Ile Phe Ser Leu Ala Arg Lys His Lys Tyr Gly Met Leu Arg Asp Leu
                        455
Asn Asn Ile Pro Pro
<210> 55
<211> 470
<212> PRT
<213> Artificial Sequence
<220>
<223> Amino acid sequence of variants of the lovE Gene
<400> 55
Met Ala Ala Asp Gln Gly Ile Phe Thr Asn Ser Val Thr Leu Ser Pro
                                    10
Val Glu Gly Ser Arg Thr Gly Gly Thr Leu Pro Arg Arg Ala Phe Arg
           20
                                25
Arg Ser Cys Asp Arg Cys His Ala Gln Lys Val Lys Cys Thr Gly Asn
                            40
Lys Glu Val Thr Gly Arg Ala Pro Cys Gln Arg Cys Gln Gln Ala Gly
                        55
Leu Arg Cys Val Tyr Ser Glu Arg Cys Pro Lys Arg Lys Leu Arg Gln
                    70
                                        75
Ser Arg Ala Ala Asp Leu Val Ser Ala Asp Pro Asp Pro Cys Leu His
                                    90
               85
Met Ser Ser Pro Pro Val Pro Ser Gln Ser Leu Pro Leu Asp Val Ser
                               105
           100
                                                   110
Glu Ser His Ser Ser Asn Thr Ser Arg Gln Phe Leu Asp Pro Pro Asp
                           120
                                               125
Ser Tyr Asp Trp Ser Trp Thr Ser Ile Gly Thr Asp Glu Ala Ile Asp
                      135
                                           140
Thr Asp Cys Trp Gly Leu Ser Gln Cys Asp Gly Gly Phe Ser Cys Gln
                   150
                                       155
Leu Glu Pro Thr Leu Pro Asp Leu Pro Ser Pro Phe Glu Ser Thr Val
               165
                                   170
Glu Lys Ala Pro Leu Pro Pro Val Ser Ser Asp Ile Ala Arg Ala Ala
                               185
Ser Ala Gln Arg Glu Leu Phe Asp Asp Leu Ser Ala Val Ser Gln Glu
                            200
```

Leu Glu Glu Ile Leu Leu Ala Val Thr Val Glu Trp Pro Lys Gln Glu

```
210
                        215
                                            220
Ile Trp Thr His Pro Ile Gly Met Phe Asn Ala Ser Arg Arg Leu
                    230
                                        235
Leu Thr Val Leu Arg Gln Gln Ala Gln Ala Asp Cys His Gln Gly Thr
                                    250
                245
Leu Asp Glu Cys Leu Arg Thr Lys Asn Leu Phe Thr Ala Val His Cys
                                265
            260
Tyr Ile Leu Asn Val Arg Ile Leu Thr Ala Ile Ser Glu Leu Leu Leu
       275
                            280
                                                285
Ser Gln Ile Arg Arg Thr Leu Asn Ser His Met Ser Pro Leu Glu Gly
                       295
                                            300
Ser Arg Ser Gln Ser Pro Ser Arg Asp Asp Thr Ser Ser Ser Gly
                   310
                                       315
His Ser Ser Val Asp Thr Ile Pro Phe Phe Ser Glu Asn Leu Pro Ile
                325
                                   330
Gly Glu Leu Phe Ser Tyr Val Asp Pro Leu Thr His Ala Leu Phe Ser
                                345
Ala Cys Thr Thr Leu His Val Gly Val Gln Leu Leu Arg Glu Asn Glu
                            360
Ile Thr Leu Gly Val His Ser Ala Gln Gly Ile Ala Ala Ser Ile Ser
                        375
                                            380
Met Ser Gly Glu Pro Gly Glu Asp Ile Ala Arg Thr Gly Ala Thr Asn
                   390
                                       395
Ser Ala Arg Cys Glu Glu Gln Pro Thr Thr Pro Ala Ala Arg Val Leu
                405
                                    410
                                                        415
Phe Met Phe Leu Ser Asp Glu Gly Ala Phe Gln Glu Ala Lys Ser Ala
           420
                                425
Gly Ser Arg Gly Arg Thr Ile Ala Ala Leu Arg Arg Cys Tyr Glu Asp
       435
                            440
Ile Phe Ser Leu Ala Arg Lys His Lys His Gly Met Leu Arg Asp Leu
                       455
Asn Asn Ile Pro Pro Cys
<210> 56
<211> 469
<212> PRT
<213> Artificial Sequence
<220>
<223> Amino acid sequence of variants of the lovE Gene
<400> 56
Met Ala Ala Asp Gln Gly Ile Phe Thr Asn Ser Val Thr Leu Ser Pro
                                    10
Val Glu Gly Ser Arg Thr Gly Gly Thr Leu Pro Arg Arg Ala Leu Arg
                                25
Arg Ser Cys Asp Arg Cys His Ala Gln Lys Ile Lys Cys Thr Gly Asn
        35
                            40
Lys Glu Val Thr Gly Arg Ala Pro Cys Gln Arg Cys Gln Gln Ala Gly
                        55
Leu Arg Cys Val Tyr Ser Glu Arg Cys Pro Lys Arg Lys Leu Arg Gln
                    70
                                        75
Ser Arg Ala Ala Asp Leu Val Ser Ala Asp Pro Asp Pro Cys Leu His
                85
```

```
Met Ser Ser Pro Ser Val Pro Ser Gln Ser Leu Pro Leu Asp Val Ser
          100 105 110
Glu Ser His Ser Ser Asn Thr Ser Arg Gln Phe Leu Asp Pro Pro Asp
                          120
Ser Tyr Asp Trp Ser Trp Thr Ser Ile Gly Thr Asp Glu Ala Ile Asp
                     135
                                         140
Thr Asp Cys Trp Gly Leu Ser Gln Arg Asp Gly Gly Phe Ser Ser Gln
                  150
                                     155
Leu Lys Pro Thr Leu Pro Asp Leu Pro Ser Pro Phe Glu Ser Thr Val
              165
                                  170
Glu Lys Ala Pro Leu Pro Pro Val Ser Ser Asp Ile Ala Arg Ala Ala
                              185
           180
Ser Ala Gln Arg Glu Leu Phe Asp Asp Leu Ser Ala Val Ser Gln Glu
                          200
                                             205
Leu Glu Glu Ile Leu Leu Ala Val Thr Val Glu Trp Pro Lys Gln Glu
                                         220
                      215
Ile Trp Thr His Pro Ile Gly Met Phe Phe Asn Ala Ser Arg Arg Leu
                  230
                                      235
Leu Thr Val Leu Arg Gln Gln Ala Gln Ala Asp Cys His Gln Gly Thr
               245
                                  250
Leu Asp Glu Cys Leu Arg Thr Lys Asn Leu Phe Thr Ala Val His Cys
           260
                              265
Tyr Ile Leu Asn Val Arg Ile Leu Thr Ala Ile Ser Glu Leu Leu Leu
       275
                           280
Ser Gln Ile Arg Leu Thr Gln Asn Ser His Met Ser Pro Leu Glu Gly
                      295
                                          300
Ser Arg Ser Gln Ser Pro Asn Arg Asp Asp Thr Ser Ser Ser Gly
                   310
                                      315
                                                      320
His Ser Ser Val Asp Thr Ile Pro Phe Phe Ser Glu Asn Leu Pro Ile
              325
                                  330
                                                     335
Gly Glu Leu Phe Ser Tyr Val Asp Pro Leu Thr His Ala Leu Phe Ser
           340
                              345
Ala Cys Thr Thr Leu His Val Gly Val Gln Leu Leu Arg Glu Asn Glu
       355
                          360
                                             365
Ile Thr Leu Gly Val His Ser Ala Gln Gly Ile Ala Ala Ser Ile Ser
                      375
                                         380
Met Ser Gly Glu Pro Gly Glu Asp Ile Ala Arg Thr Gly Ala Thr Asn
                  390
                                      395
Ser Ala Arg Cys Glu Glu Gln Pro Thr Thr Pro Ala Ala Arg Val Leu
               405
                                  410
Phe Met Phe Leu Ser Asp Glu Gly Ala Phe Gln Glu Ala Lys Ser Ala
                              425
                                                 430
Gly Ser Arg Gly Arg Thr Ile Ala Ala Leu Arg Arg Cys Tyr Glu Asp
                          440
                                             445
Ile Phe Ser Leu Ala Arg Lys His Lys His Gly Met Leu Arg Asp Leu
                       455
Asn Asn Ile Pro Pro
465
<210> 57
```

```
<211> 469
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<223> Amino acid sequence of variants of the lovE Gene

<sup>&</sup>lt;212> PRT

<sup>&</sup>lt;213> Artificial Sequence

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<400> 57
Met Ala Ala Asp Gln Gly Ile Phe Thr Asn Ser Val Thr Ile Ser Pro
                                   10
Val Val Gly Ser Arg Thr Gly Gly Thr Leu Pro Arg Arg Ala Phe Arg
                              25
Arg Ser Cys Asp Arg Cys His Ala Gln Lys Ile Lys Cys Thr Gly Asn
                           40
Lys Glu Val Thr Gly Arg Ala Pro Cys Gln Arg Cys Gln Gln Ala Gly
Leu Arg Cys Val Tyr Ser Glu Arg Cys Pro Lys Arg Lys Leu Arg Gln
Ser Arg Ala Ala Asp Leu Val Ser Ala Asp Pro Asp Pro Cys Leu His
                                   90
Met Ser Ser Pro Pro Val Pro Ser Gln Ser Leu Pro Leu Asp Val Ser
                               105
           100
Glu Ser His Ser Ser Asn Thr Ser Arg Gln Phe Leu Asp Pro Pro Asp
                           120
       115
Ser Tyr Asp Trp Ser Trp Thr Ser Ile Cys Thr Asp Glu Ala Ile Asp
                      135
                                           140
Thr Asp Cys Trp Gly Leu Ser Gln Cys Asp Gly Gly Phe Ser Cys Gln
                   150
                                       155
Leu Glu Pro Thr Leu Pro Asp Leu Pro Ser Pro Phe Glu Ser Thr Val
                                   170
              165
Glu Lys Ala Pro Leu Pro Pro Val Ser Ser Asp Ile Ala Arg Ala Ala
           180
                               185
Ser Ala Gln Arg Glu Leu Phe Asp Asp Leu Ser Ala Val Ser Gln Glu
       195
                           200
                                               205
Leu Glu Glu Ile Leu Leu Ala Val Thr Val Glu Trp Pro Lys Gln Glu
                       215
                                           220
Ile Trp Thr His Pro Ile Gly Met Phe Phe Asn Ala Ser Arg Arg Leu
                  230
                                       235
Leu Thr Val Leu Arg Gln Gln Ala Gln Ala Asp Cys His Gln Gly Thr
                                   250
               245
Leu Asp Glu Cys Leu Arg Thr Lys Asn Leu Phe Thr Ala Val His Cys
                               265
           260
Tyr Ile Leu Asn Val Arg Ile Leu Thr Ala Ile Ser Glu Leu Leu
                           280
Ser Gln Ile Arg Arg Thr Gln Asn Ser His Met Ser Pro Leu Glu Gly
                      295
                                           300
Ser Arg Ser Gln Ser Pro Ser Arg Asp Asp Thr Ser Ser Ser Gly
                   310
                                     315
His Ser Ser Val Asp Thr Ile Pro Phe Phe Ser Glu Asn Leu Pro Ile
               325
                                   330
Gly Gly Leu Phe Ser Tyr Val Asp Pro Leu Thr His Ala Leu Phe Ser
                               345
Ala Cys Thr Thr Leu His Val Gly Leu Gln Leu Leu Arg Glu Asn Glu
                           360
Ile Thr Leu Gly Val His Ser Ala Gln Gly Ile Ala Ala Ser Ile Ser
                        375
                                           380
Met Ser Gly Glu Ser Gly Glu Asp Ile Ala Arg Thr Gly Ala Thr Ser
                    390
                                        395
Ser Ala Arg Cys Glu Glu Gln Pro Thr Thr Pro Ala Ala Arg Val Leu
               405
                                   410
Phe Met Phe Leu Ser Asp Glu Gly Ala Phe Gln Glu Ala Lys Ser Ala
                               425
Gly Ser Arg Gly Arg Thr Ile Ala Ala Leu Arg Arg Cys Tyr Glu Asp
                           440
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```
Ile Phe Ser Leu Ala Arg Lys His Lys His Gly Met Leu Arg Asp Leu
                        455
Asn Asn Ile Pro Pro
465
<210> 58
<211> 469
<212> PRT
<213> Artificial Sequence
<223> Amino acid sequence of variants of the lovE Gene
Met Ala Ala Asp Gln Gly Ile Phe Thr Asn Ser Val Thr Leu Ser Pro
Val Glu Gly Ser Arg Thr Gly Gly Thr Leu Pro Arg Arg Ala Phe Arg
                                25
Arg Ser Cys Asp Arg Cys His Ala Arg Lys Ile Lys Cys Thr Gly Asn
                           40
Lys Glu Val Thr Gly Arg Ala Pro Cys Gln Arg Cys Gln Gln Ala Gly
                        55
Leu Arg Cys Val Tyr Ser Glu Arg Cys Pro Lys Arg Lys Leu Arg Gln
                                        75
                   70
Ser Arg Ala Ala Asp Leu Val Ser Ala Asp Pro Asp Pro Cys Leu His
                85
                                   90
Met Ser Ser Pro Pro Val Pro Ser Gln Ser Leu Pro Leu Asp Val Ser
            100
                               105
Glu Ser His Ser Ser Asn Thr Ser Arg Gln Phe Leu Asp Pro Pro Asp
                           120
                                                125
       115
Ser Tyr Asp Trp Ser Trp Thr Ser Ile Gly Thr Asp Glu Ala Ile Asp
                       135
                                           140
Thr Asp Cys Trp Gly Leu Ser Gln Cys Asp Gly Gly Phe Ser Cys Gln
                                       155
                   150
Leu Glu Pro Thr Leu Pro Asp Leu Pro Ser Pro Phe Glu Tyr Thr Val
               165
                                                       175
                                   170
Glu Lys Ala Pro Leu Pro Pro Val Ser Ser Asp Ile Ala Arg Ala Ala
                               185
           180
Ser Ala Gln Arg Glu Leu Phe Asp Asp Leu Ser Ala Val Ser Gln Glu
                           200
                                               205
Leu Glu Glu Ile Leu Leu Ala Val Thr Val Glu Trp Pro Lys Gln Glu
                       215
                                           220
Ile Trp Thr His Pro Ile Gly Met Phe Phe Asn Ala Ser Arg Arg Leu
                   230
                                        235
Leu Thr Val Leu Arg Gln Gln Ala Gln Ala Asp Cys His Gln Gly Thr
                245
                                    250
Leu Asp Glu Cys Leu Arg Thr Lys Asn Leu Phe Thr Ala Val His Cys
                                265
            260
Tyr Ile Leu Asn Val Arg Ile Leu Thr Ala Ile Ser Glu Leu Leu
                            280
                                                285
        275
Ser Gln Ile Arg Arg Thr Gln Asn Ser His Met Ser Pro Leu Glu Gly
                        295
                                            300
Ser Arg Ser Gln Ser Pro Ser Arg Asp Asp Thr Ser Ser Ser Ser Gly
                                        315
                    310
His Ser Ser Val Asp Thr Ile Pro Phe Phe Ser Glu Asn Leu Pro Ile
                325
                                    330
                                                        335
```

```
Gly Glu Leu Phe Ser Tyr Val Asp Pro Leu Thr His Ala Leu Phe Ser
                                345
            340
Ala Cys Thr Thr Leu His Val Gly Val Gln Leu Leu Arg Glu Asn Glu
                            360
                                                365
        355
Ile Thr Leu Gly Val His Ser Ala Gln Gly Ile Ala Ala Ser Ile Ser
                        375
Met Ser Gly Glu Pro Gly Glu Asp Ile Ala Arg Thr Gly Ala Thr Asn
                    390
                                        395
Ser Thr Arg Cys Glu Glu Gln Pro Thr Thr Pro Ala Ala Arg Val Leu
                                    410
               405
Phe Met Phe Leu Ser Asp Glu Gly Ala Phe Gln Glu Ala Lys Ser Ala
                               425
                                                    430
           420
Gly Ser Arg Gly Arg Thr Ile Ala Ala Leu Arg Arg Cys Tyr Glu Asp
                           440
Ile Phe Ser Leu Ala Arg Lys His Lys His Gly Met Leu Arg Asp Leu
                        455
Asn Asn Ile Pro Pro
<210> 59
<211> 469
<212> PRT
<213> Artificial Sequence
<220>
<223> Amino acid sequence of variants of the lovE Gene
Met Ala Ala Asp Gln Gly Ile Phe Thr Asn Ser Val Thr Leu Ser Pro
                                    10
Val Glu Gly Ser Arg Thr Gly Gly Thr Leu Pro Arg Arg Ala Leu Arg
                                25
Arg Ser Cys Asp Arg Cys His Ala Gln Lys Ile Lys Cys Thr Gly Asn
                            40
Lys Glu Val Ile Gly Arg Ala Pro Cys Gln Arg Cys Gln Gln Ala Gly
                        55
Leu Arg Cys Val Tyr Ser Glu Arg Cys Pro Lys Arg Lys Leu Arg Gln
                                        75
Ser Arg Ala Ala Asp Leu Val Ser Ala Asp Pro Asp Pro Cys Leu His
                                    90
               8.5
Met Ser Ser Pro Gln Val Pro Ser Gln Ser Leu Ser Leu Asp Ile Ser
                               105
                                                   110
           100
Glu Ser His Ser Ser Asn Thr Ser Arg Gln Phe Leu Asp Pro Pro Asp
                           120
                                               125
        115
Ser Tyr Asp Trp Ser Trp Thr Ser Ile Gly Thr Asp Glu Ala Ile Asp
                                           140
                      135
Thr Asp Cys Trp Gly Leu Ser Gln Cys Asp Gly Gly Phe Ser Cys Gln
                   150 155
Leu Glu Pro Thr Leu Pro Asp Leu Pro Ser Pro Phe Glu Ser Thr Val
                                   170
                165
Glu Lys Ala Pro Leu Pro Pro Val Ser Ser Asp Ile Ala Arg Ala Ala
                               185
Ser Ala Gln Arg Glu Leu Phe Asp Asp Leu Ser Ala Val Ser Gln Glu
                           200
Leu Glu Glu Ile Leu Leu Ala Val Thr Val Glu Trp Pro Lys Gln Glu
```

```
Ile Trp Thr His Pro Ile Gly Met Phe Phe Asn Ala Ser Arg Arg Leu
                    230
                                        235
225
Leu Thr Val Leu Arg Gln Gln Ala Gln Ala Asp Cys His Gln Gly Thr
                                    250
               245
Leu Asp Glu Cys Leu Arg Thr Lys Asn Leu Phe Thr Ala Val His Cys
           260
                                265
Tyr Ile Leu Asn Val Arg Ile Leu Thr Ala Ile Ser Glu Leu Leu
                           280
                                                285
Ser Gln Ile Arg Arg Thr Gln Asn Ser His Met Ser Pro Leu Glu Gly
                       295
                                            300
Ser Arg Ser Gln Ser Pro Ser Arg Asp Asp Thr Ser Ser Ser Gly
                                       315
                    310
His Ser Ser Val Asp Thr Ile Pro Phe Phe Ser Glu Asn Leu Pro Ile
                                   330
               325
Gly Glu Leu Phe Ser Tyr Val Asp Pro Leu Thr His Ala Leu Phe Ser
                               345
           340
Ala Cys Thr Thr Leu His Val Gly Val Gln Leu Leu Arg Glu Asn Glu
                           360
                                               365
Ile Thr Leu Gly Val His Ser Ala Gln Gly Ile Ala Ala Ser Ile Ser
                       375
Met Ser Gly Glu Pro Gly Glu Asp Ile Ala Arg Thr Gly Ala Thr Asn
                   390
                                       395
Ser Ala Arg Cys Glu Glu Gln Pro Thr Thr Pro Ala Ala Arg Val Leu
               405
                                   410
Phe Met Phe Leu Ser Asp Glu Gly Ala Phe Gln Glu Ala Lys Ser Ala
                               425
           420
Gly Ser Arg Gly Arg Thr Ile Ala Ala Leu Arg Arg Cys Tyr Glu Asp
    435
                           440
Ile Phe Ser Leu Ala Arg Lys His Lys His Gly Met Leu Arg Asp Leu
                       455
Asn Asn Ile Pro Pro
465
<210> 60
<211> 469
<212> PRT
<213> Artificial Sequence
<220>
<223> Amino acid sequence of variants of the lovE Gene
<400> 60
Met Ala Ala Asp Gln Gly Ile Phe Thr Asn Ser Val Thr Leu Ser Pro
                                   10
Val Glu Gly Ser Arg Thr Gly Gly Thr Leu Pro Arg Arg Ala Phe Arg
                                25
Arg Ser Cys Asp Arg Cys His Ala Gln Lys Ile Lys Cys Thr Gly Asn
                           40
Lys Glu Val Thr Gly Arg Ala Pro Cys Gln Arg Cys Gln Gln Ala Gly
                       55
Leu Arg Cys Val Tyr Ser Glu Arg Cys Pro Lys Arg Lys Leu Arg Gln
                                       75
Ser Arg Ala Ala Asn Leu Val Ser Ala Asp Pro Asp Pro Cys Leu His
                85
                                   90
Met Ser Ser Pro Pro Val Pro Ser Gln Ser Leu Pro Leu Asp Val Ser
            100
                                                   110
```

```
Glu Ser His Ser Ser Asn Thr Ser Arg Gln Phe Leu Asp Pro Pro Asp
                         120
  115
Ser Tyr Asp Trp Ser Trp Thr Ser Ile Gly Thr Asp Glu Ala Phe Asp
                     135
                                         140
Thr Asp Cys Trp Gly Leu Ser Gln Cys Asp Gly Gly Phe Ser Cys Gln
                 150
                                    155
Leu Glu Pro Thr Leu Pro Asp Leu Pro Ser Pro Phe Glu Ser Thr Val
                                170
              165
Glu Lys Ala Pro Leu Pro Pro Val Ser Ser Asp Ile Ala Arg Ala Ala
                             185
Ser Ala Gln Arg Glu Leu Phe Asp Asp Leu Ser Ala Val Ser Gln Glu
                         200
                                 205
Leu Glu Glu Ile Leu Leu Ala Val Thr Val Glu Trp Pro Lys Gln Glu
                     215
                                        220
Ile Trp Thr His Pro Ile Gly Ile Phe Phe Asn Ala Ser Arg Arg Leu
                 230
                                    235
Leu Thr Val Leu Arg Gln Gln Ala Gln Ala Asp Cys His Gln Gly Thr
                                250
Leu Asp Glu Cys Leu Arg Thr Lys Asn Leu Phe Thr Ala Val His Cys
                             265
          260
Tyr Ile Leu Asn Val Arg Ile Leu Thr Ala Ile Ser Glu Leu Leu Leu
                         280
                                            285
       275
Ser Gln Ile Arg Arg Thr Gln Asn Ser His Met Ser Pro Leu Glu Gly
                                         300
                      295
Ser Arg Ser Gln Ser Pro Ser Arg Asp Asp Ile Ser Ser Ser Gly
                  310
                                    315
His Ser Ser Val Asp Thr Ile Pro Phe Phe Ser Glu Asn Leu Pro Ile
              325
                                 330
Gly Glu Leu Phe Ser Tyr Val Asp Pro Leu Thr His Ala Leu Phe Ser
                             345
                                                350
Ala Cys Thr Thr Leu His Val Gly Val Gln Leu Leu Arg Glu Asn Glu
       355
                          360
Ile Thr Leu Gly Val His Ser Ala Gln Gly Ile Ala Ala Tyr Ile Ser
                      375
                                         380
Lys Ser Gly Glu Pro Gly Glu Asp Ile Ala Arg Thr Gly Ala Thr Asn
                  390
                                    395
Ser Ala Arg Cys Glu Glu Gln Pro Thr Thr Pro Ala Ala Arg Val Leu
              405
                                 410
Phe Met Phe Leu Ser Asp Glu Gly Ala Phe Gln Glu Ala Lys Ser Ala
                             425
                                                430
          420
Gly Ser Arg Gly Arg Thr Ile Ala Ala Leu Arg Arg Cys Tyr Glu Asp
                         440
                                            445
Ile Phe Ser Leu Ala Arg Lys His Lys His Gly Met Leu Arg Asp Leu
                      455
Asn Asn Ile Pro Pro
<210> 61
<211> 469
<212> PRT
<213> Artificial Sequence
<223> Amino acid sequence of variants of the lovE Gene
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<400> 61

Met Ala Ala Asp Gln Gly Ile Phe Thr Asn Ser Val Thr Leu Ser Pro 10 Val Glu Gly Ser Arg Thr Gly Gly Thr Leu Pro Arg Arg Ala Phe Arg 25 Arg Ser Cys Asp Arg Cys His Ala Gln Lys Ile Lys Cys Ile Gly Asn 40 Lys Glu Val Thr Gly Arg Ala Pro Cys Gln Arg Cys Gln Arg Ala Gly Leu Arg Cys Val Tyr Ser Glu Arg Cys Pro Lys Arg Arg Leu Arg Gln 75 Ser Arq Ala Ala Asp Leu Val Ser Ala Asp Pro Asp Pro Cys Leu His 90 Met Ser Ser Pro Pro Val Pro Ser Gln Ser Leu Pro Leu Asp Val Ser 105 100 Glu Ser His Ser Ser Asn Thr Ser Arg Gln Phe Leu Asp Pro Pro Asp 120 115 Ser Tyr Asp Trp Ser Trp Thr Ser Ile Gly Thr Asp Glu Ala Ile Asp 140 135 Thr Asp Cys Trp Gly Leu Ser Gln Cys Asp Gly Gly Phe Ser Cys Gln 150 155 Leu Glu Pro Thr Leu Pro Asp Leu Pro Ser Pro Phe Glu Ser Thr Val 170 165 Glu Lys Ala Pro Leu Pro Pro Val Ser Ser Asp Ile Ala Arg Ala Ala 185 Ser Ala Gln Arg Glu Leu Phe Asp Asp Leu Ser Ala Val Ser Gln Glu 200 205 195 . Leu Glu Glu Ile Leu Leu Ala Val Thr Val Glu Trp Pro Lys Gln Glu 215 220 Ile Trp Thr His Pro Ile Gly Met Phe Phe Asn Ala Ser Arg Arg Leu 230 235 Leu Thr Val Leu Arg Gln Gln Ala Gln Ala Asp Cys His Gln Gly Thr 250 245 255 Leu Asp Glu Cys Leu Arg Thr Lys Asn Leu Phe Thr Ala Val His Cys 260 265 Tyr Ile Leu Asn Val Arg Ile Leu Thr Ala Ile Ser Glu Leu Leu 280 Ser Gln Ile Arg Arg Thr Gln Asn Ser His Met Ser Pro Leu Glu Gly 295 300 Ser Arg Ser Gln Ser Pro Ser Arg Asp Asp Thr Ser Ser Ser Gly 310 315 His Ser Cys Val Asp Thr Ile Pro Phe Phe Ser Glu Asn Leu Pro Ile 325 330 Gly Glu Leu Phe Ser Tyr Val Asp Pro Leu Thr His Ala Leu Phe Ser 345 Ala Cys Thr Thr Leu His Val Gly Val Gln Leu Leu Arg Glu Tyr Glu 360 Ile Thr Leu Gly Ile His Ser Ala Gln Gly Ile Ala Ala Ser Ile Ser 375 380 Met Ser Gly Glu Pro Gly Glu Asp Ile Ala Arg Thr Gly Ala Thr Asn 390 395 Ser Ala Arg Cys Glu Glu Gln Pro Thr Thr Pro Ala Ala Arg Val Leu 405 410 Phe Met Phe Leu Ser Asp Glu Gly Ala Phe Gln Glu Ala Lys Ser Ala 425 430 Gly Ser Arg Gly Arg Thr Ile Ala Ala Leu Arg Arg Cys Tyr Glu Asp 440 Ile Phe Ser Leu Ala Arg Lys His Lys His Gly Met Leu Arg Asp Leu

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455
                                            460
   450
Asn Asn Ile Pro Pro
465
<210> 62
<211> 469
<212> PRT
<213> Artificial Sequence
<223> Amino acid sequence of variants of the lovE Gene
<400> 62
Met Ala Ala Asp Gln Gly Ile Phe Thr Asn Ser Val Thr Leu Ser Pro
Val Glu Gly Ser Arg Thr Gly Gly Thr Leu Pro Arg Arg Ala Phe Arg
                                25
            2.0
Arg Ser Cys Asp Arg Cys His Ala Arg Lys Ile Lys Cys Thr Gly Asn
                           4.0
        35
Lys Glu Val Thr Gly Arg Ala Pro Cys Gln Arg Cys Gln Gln Ala Gly
                        55
Leu Arg Cys Val Tyr Ser Glu Arg Cys Pro Lys Arg Lys Leu Arg Gln
                   70
                                        75
Ser Arg Ala Ala Asp Leu Val Ser Ala Asp Pro Asp Pro Cys Leu His
               85
                                    90
Met Ser Ser Pro Pro Val Pro Ser Gln Ser Leu Pro Leu Asp Val Ser
                                105
Glu Ser His Ser Ser Asn Thr Ser Arg Gln Phe Leu Asp Pro Pro Asp
                            120
Ser Tyr Asp Trp Ser Trp Thr Ser Ile Gly Thr Asp Glu Ala Ile Asp
                       135
Thr Asp Cys Trp Gly Leu Ser Gln Cys Asp Gly Gly Phe Ser Cys Gln
                   150
                                        155
Leu Glu Pro Thr Leu Pro Asp Leu Pro Ser Pro Phe Glu Ser Thr Val
                                    170
                165
Glu Lys Ala Pro Leu Pro Pro Val Ser Ser Asp Ile Ala Arg Ala Ala
                                185
            180
Ser Ala Gln Arg Glu Leu Phe Asp Asp Leu Ser Ala Val Ser Gln Glu
                            200
Leu Glu Glu Ile Leu Leu Ala Val Thr Val Glu Trp Pro Lys Gln Glu
                        215
                                            220
Ile Trp Thr His Pro Ile Gly Met Phe Phe Asn Ala Ser Arg Arg Leu
                    230
                                        235
Leu Thr Val Leu Arg Gln Gln Ala Gln Ala Asp Cys His Gln Gly Thr
                245
                                    250
Leu Asp Glu Cys Leu Arg Thr Lys Asn Leu Phe Thr Ala Val His Cys
            260
                                265
Tyr Ile Leu Asn Val Arg Ile Leu Thr Ala Ile Ser Glu Leu Leu Leu
                            280
Ser Gln Ile Arg Arg Ile Gln Asn Ser His Met Ser Pro Leu Glu Gly
                        295
                                            300
Ser Arg Ser Gln Ser Leu Ser Arg Asp Asp Thr Ser Ser Ser Gly
                                        315
                   310
His Ser Ser Val Asp Thr Ile Pro Phe Phe Ser Glu Asn Leu Pro Ile
                                   330
               325
Asp Glu Leu Phe Ser Tyr Val Asp Pro Leu Thr His Ala Leu Phe Ser
```

```
345
            340
Ala Cys Thr Thr Leu His Val Gly Val Gln Leu Leu Arg Glu Asn Glu
                          360
                                               365
Ile Thr Leu Gly Val His Ser Ala Gln Gly Ile Ala Ala Ser Ile Ser
                                           380
                       375
Met Ser Gly Glu Leu Gly Glu Asp Ile Val Arg Thr Gly Ala Thr Asn
                   390
                                       395
Ser Ala Arg Cys Glu Glu Gln Pro Thr Thr Pro Ala Ala Arg Val Leu
                                   410
Phe Met Phe Leu Ser Asp Glu Gly Ala Phe Gln Glu Ala Lys Ser Ala
                               425
Gly Ser Arg Ser Arg Thr Ile Ala Ala Leu Arg Arg Cys Tyr Glu Asp
                           440
Ile Phe Ser Leu Ala Arg Lys His Lys His Gly Met Leu Arg Asp Leu
                        455
Asn Asn Ile Pro Pro
465
<210> 63
<211> 469
<212> PRT
<213> Artificial Sequence
<223> Amino acid sequence of variants of the lovE Gene
<400> 63
Met Ala Ala Asp Gln Gly Ile Phe Thr Asn Ser Val Thr Leu Ser Pro
                                    10
Val Glu Gly Ser Arg Thr Gly Gly Thr Leu Pro Arg Arg Ala Phe Arg
                                25
Arg Ser Cys Asp Arg Cys His Ala Gln Lys Ile Lys Cys Thr Gly Asn
                           40
       35
Lys Glu Val Asn Gly Arg Ala Pro Cys Gln Arg Cys Gln Gln Ala Gly
                        55
                                            60
Leu Arg Cys Val Tyr Ser Glu Arg Cys Pro Lys Arg Lys Leu Arg Gln
                   70
                                       75
Ser Arg Ala Ala Asp Leu Val Ser Ala Asp Pro Asp Pro Cys Leu His
                8.5
                                    90
Met Ser Ser Pro Pro Val Pro Ser Gln Ser Leu Pro Leu Asp Ile Ser
            100
                                105
Glu Ser His Ser Ser Asn Thr Ser Arg Gln Phe Leu Asp Pro Pro Asp
                            120
                                                125
Ser Tyr Asp Trp Ser Trp Thr Ser Ile Gly Ile Asp Glu Ala Ile Asp
                        135
                                            140
Thr Asp Cys Trp Gly Leu Ser Gln Cys Asp Gly Gly Phe Ser Cys Gln
                    150
                                        155
Leu Glu Pro Thr Leu Pro Asp Leu Pro Ser Pro Phe Glu Ser Thr Val
                165
                                    170
Glu Lys Ala Pro Leu Pro Pro Ile Ser Ser Asp Ile Ala Arg Ala Ala
                                185
                                                    190
Ser Ala Gln Arg Glu Leu Phe Asp Asp Leu Ser Ala Val Ser Gln Glu
                            200
Leu Glu Glu Ile Leu Leu Ala Val Thr Val Glu Trp Pro Lys Gln Glu
                        215
Ile Trp Thr His Pro Ile Gly Met Phe Phe Asn Ala Ser Arg Arg Leu
```

235

230

225

```
Leu Thr Val Leu Arg Gln Gln Ala Gln Ala Asp Cys His Gln Gly Thr
                                   250
              245
Leu Asp Glu Cys Leu Arg Thr Lys Asn Leu Phe Thr Ala Val His Cys
           260
                               265
Tyr Ile Leu Asn Val Arg Ile Leu Ala Ala Ile Ser Glu Leu Leu Leu
                           280
       275
Ser Gln Ile Arg Arg Thr Gln Asn Ser His Met Ser Pro Leu Glu Gly
                      295
                               . 300
Ser Arg Ser Gln Ser Pro Ser Arg Asp Asp Thr Ser Ser Ser Gly
                   310
                                       315
His Ser Ser Val Asp Thr Ile Pro Phe Phe Ser Glu Asn Leu Pro Ile
                                   330
Gly Glu Leu Phe Ser Tyr Val Asp Pro Leu Thr His Ala Leu Phe Ser
                               345
Ala Cys Thr Thr Leu His Val Gly Val Gln Leu Leu Arg Glu Asn Glu
                           360
                                               365
Ile Thr Leu Gly Val His Ser Ala Gln Gly Ile Ala Ala Ser Ile Ser
                       375
                                           380
Met Ser Gly Glu Pro Gly Glu Asp Ile Ala Arg Thr Gly Ala Thr Asn
                   390
                                       395
Ser Ala Arg Cys Glu Glu Gln Pro Thr Thr Pro Ala Ala Arg Val Leu
               405
                                   410
Phe Met Phe Leu Ser Asp Glu Gly Ala Phe Gln Glu Ala Lys Ser Ala
           420
                               425
Gly Ser Arg Gly Arg Thr Ile Ala Ala Leu Arg Arg Cys Tyr Glu Asp
                           440
                                               445
Ile Phe Ser Leu Ala Arg Lys His Lys His Gly Met Leu Arg Asp Leu
                       455
Asn Asn Ile Pro Pro
465
<210> 64
<211> 469
<212> PRT
<213> Artificial Sequence
<223> Amino acid sequence of variants of the lovE Gene
<400> 64
Met Ala Ala Glu Gln Gly Ile Phe Thr Asn Ser Val Thr Leu Ser Pro
Val Glu Gly Ser Arg Thr Gly Gly Thr Leu Pro Arg Arg Ala Phe Arg
            20
                               25
Arg Ser Cys Asp Arg Cys His Ala Arg Lys Ile Lys Cys Thr Gly Asn
        35
                           40
Lys Glu Val Thr Gly Arg Ala Pro Cys Gln Arg Cys Gln Gln Ala Gly
                        55
                                           60
Leu Arg Cys Val Tyr Ser Glu Arg Cys Pro Lys Arg Lys Leu Arg Gln
                                       75
                    70
Ser Arg Ala Ala Asp Leu Ile Ser Ala Asp Pro Asp Pro Cys Leu His
               85
                                   90
Met Ser Ser Pro Pro Val Pro Ser Gln Ser Leu Pro Leu Glu Val Ser
                               105
Glu Ser His Ser Ser Asn Thr Ser Arg Gln Phe Leu Asp Pro Pro Asp
```

```
120
       115
Ser Tyr Asp Trp Ser Trp Thr Ser Ile Gly Thr Asp Lys Ala Ile Asp
                      135
   130
                                           140
Thr Asp Cys Trp Gly Leu Ser Gln Cys Asp Gly Gly Phe Ser Cys Gln
                                      155
                  150
Leu Glu Pro Thr Leu Pro Asp Leu Pro Ser Pro Phe Glu Ser Thr Val
                                  170
              165
Glu Lys Ala Pro Leu Pro Pro Val Ser Ser Asp Ile Thr Arg Ala Ala
                              185
           180
Ser Ala Gln Arg Glu Leu Phe Asp Asp Leu Ser Ala Val Ser Gln Glu
                           200
Leu Glu Glu Ile Leu Leu Ala Val Thr Val Glu Trp Pro Lys Gln Glu
                                          220
                       215
Ile Trp Thr His Pro Ile Gly Met Phe Phe Asn Ala Ser Arg Arg Leu
                   230
                                       235
Leu Thr Val Leu Arg Gln Gln Ala Gln Ala Asp Cys His Gln Gly Thr
                                  250
Leu Asp Glu Cys Leu Arg Thr Lys Asn Leu Phe Thr Ala Val His Cys
           260
                               265
Tyr Ile Leu Asp Val Arg Ile Leu Thr Ala Ile Ser Glu Leu Leu
                           280
Ser Gln Ile Arg Arg Thr Gln Asn Ser His Met Ser Pro Leu Glu Gly
                       295
                                           300
Ser Arg Ser Gln Ser Pro Ser Arg Asp Asp Thr Ser Ser Ser Gly
                   310
                                       315
His Ser Ser Val Asp Thr Ile Pro Phe Phe Ser Glu Asn Leu Pro Ile
               325
                                   330
Gly Glu Leu Phe Ser Tyr Val Asp Pro Leu Arg His Ala Leu Phe Ser
                               345
Ala Cys Thr Thr Leu His Val Gly Val Gln Leu Leu Arg Glu Ile Glu
                           360
Ile Thr Leu Gly Val His Ser Ala Arg Gly Ile Ala Ala Ser Ile Ser
                       375
                                           380
Met Ser Gly Glu Pro Gly Glu Asp Ile Ala Arg Thr Gly Ala Thr Asn
                   390
                                       395
Ser Ala Arg Cys Glu Glu Gln Pro Thr Thr Pro Ala Ala Arg Val Leu
               405
                                   410
Phe Met Phe Leu Ser Asp Glu Gly Thr Phe Gln Glu Ala Lys Ser Ala
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Gly Ser Arg Gly Arg Thr Ile Ala Ala Leu Arg Arg Cys Tyr Glu Asp
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Ile Phe Ser Leu Ala Arg Lys His Lys His Gly Met Leu Arg Asp Leu
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Arg Ser Cys Asp Arg Cys His Ala Gln Lys Ile Lys Cys Thr Gly Asn
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Lys Glu Val Thr Gly Arg Ala Pro Cys Gln Arg Cys Gln Gln Ala Gly
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Leu Arg Cys Val Tyr Ser Glu Arg Cys Pro Lys Arg Lys Leu Arg Gln
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Ser Arg Ala Ala Asp Leu Val Ser Ala Asp Pro Asp Pro Cys Leu His
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Met Ser Ser Pro Pro Val Pro Ser Gln Ser Leu Pro Leu Asp Val Ser
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Glu Ser His Ser Ser Asn Thr Ser Arg Gln Phe Leu Asp Pro Pro Asp
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Ser Tyr Asn Trp Leu Trp Thr Ser Ile Gly Thr Asp Glu Ala Ile Asp
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Thr Asp Cys Trp Gly Leu Ser Gln Cys Asp Gly Gly Phe Ser Cys Gln
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Leu Glu Pro Thr Leu Pro Asp Leu Pro Ser Pro Phe Glu Ser Thr Val
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Glu Lys Ala Pro Leu Pro Pro Val Ser Ser Asp Ile Ala Arg Ala Ala
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Ser Ala Gln Arg Glu Leu Phe Asp Asp Leu Ser Ala Val Ser Gln Glu
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Leu Glu Glu Ile Leu Leu Ala Val Thr Val Glu Trp Pro Lys Gln Glu
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Ile Trp Thr His Pro Ile Gly Met Phe Phe Asn Ala Ser Arg Arg Leu
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Leu Thr Val Leu Arg Gln Gln Ala Gln Ala Asp Cys His Gln Gly Thr
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Leu Asp Glu Cys Leu Arg Thr Lys Asn Leu Phe Thr Ala Val His Cys
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Tyr Ile Leu Asn Val Arg Ile Leu Thr Ala Ile Ser Glu Leu Leu Leu
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Ser Gln Ile Arg Arg Thr Gln Asn Ser His Met Ser Pro Leu Glu Gly
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Ser Arg Ser Gln Ser Pro Ser Gly Asp Asp Thr Ser Ser Ser Ser Gly
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His Ser Ser Val Asp Thr Ile Pro Phe Phe Ser Glu Asn Leu Pro Ile
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Gly Glu Leu Phe Ser Tyr Val Asp Pro Leu Thr His Ala Leu Phe Ser
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Ala Cys Thr Thr Leu His Val Gly Val Gln Leu Leu Arg Glu Asn Glu
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Ile Thr Leu Gly Val His Ser Ala Gln Gly Ile Ala Ala Ser Ile Ser
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Met Ser Gly Glu Pro Gly Glu Asp Ile Ala Arg Thr Gly Ala Thr Asn
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Ser Ala Arg Cys Glu Glu Gln Pro Thr Thr Pro Ala Ala Arg Val Leu
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Phe Met Phe Leu Ser Asp Glu Gly Ala Phe Gln Glu Gly Lys Ser Ala
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Gly Ser Arg Gly Arg Thr Ile Ala Ala Leu Arg Arg Cys Tyr Glu Asp
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caaaaqatca aatqtactqq aaataaqqaq qttactqqcc qtqctccctq tcaqcqttqc 180
cagcaggetg gacttegatg egtetacagt gagegatgee ecaagegeaa getaegeeaa 240
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caacgggctg gacttcgatg cgtctacagt gagcgatgcc ccaagcgcag gctacgccaa 240
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<210> 87
<211> 1410
<212> DNA
<213> Artificial Sequence
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<223> DNA sequence of variants of the lovE Gene
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Lys Glu Val Thr Gly Arg Ala Pro Cys Gln Arg Cys Gln Gln Ala Gly
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Leu Arg Cys Val Tyr Ser Glu Arg Cys Pro Lys Arg Lys Leu Arg Gln
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Ser Arg Ala Ala Asp Leu Val Ser Ala Asp Pro Asp Pro Cys Leu His
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Met Ser Ser Pro Pro Val Pro Ser Gln Ser Leu Pro Leu Asp Val Ser
           100
                               105
Glu Ser His Ser Ser Asn Thr Ser Arg Gln Phe Leu Asp Pro Pro Asp
                           120
                                               125
Ser Tyr Asp Trp Ser Trp Thr Ser Ile Gly Thr Asp Glu Ala Ile Asp
                       135
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Thr Asp Cys Trp Gly Leu Ser Gln Cys Asp Gly Gly Phe Ser Cys Gln
                   150
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Leu Glu Pro Thr Leu Pro Asp Leu Pro Ser Pro Phe Glu Ser Thr Val
               165
                                   170
Glu Lys Ala Pro Leu Pro Pro Val Ser Ser Asp Ile Ala Arg Ala Ala
           180
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Ser Ala Gln Arg Glu Leu Phe Asp Asp Leu Ser Ala Val Ser Gln Glu
                           200
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Leu Glu Glu Ile Leu Leu Ala Val Thr Val Glu Trp Pro Lys Gln Glu
                       215
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Ile Trp Thr His Pro Ile Gly Met Phe Phe Asn Ala Ser Arg Arg Leu
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                                      235
Leu Thr Val Leu Arg Gln Gln Ala Gln Ala Asp Cys His Gln Gly Thr
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Leu Asp Glu Cys Leu Arg Thr Lys Asn Leu Phe Thr Ala Val His Cys
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                               265
Tyr Ile Leu Asn Val Arg Ile Leu Thr Ala Ile Ser Glu Leu Leu
       275
                           280
Ser Gln Ile Arg Arg Thr Gln Asn Ser His Met Ser Pro Leu Glu Glv
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Ser Arg Ser Gln Ser Pro Ser Arg Asp Asp Thr Ser Ser Ser Gly
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                                       315
                                                            320
His Ser Ser Val Asp Thr Ile Pro Phe Phe Ser Glu Asn Leu Pro Ile
               325
                                   330
Gly Glu Leu Phe Ser Tyr Val Asp Pro Leu Thr His Ala Leu Phe Ser
                               345
Ala Cys Thr Thr Leu His Val Gly Val Gln Leu Leu Arg Glu Asn Glu
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Ile Thr Leu Gly Val His Ser Ala Gln Gly Ile Ala Ala Ser Ile Ser
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Met Ser Gly Glu Pro Gly Glu Asp Ile Ala Arg Thr Gly Ala Thr Asn
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